FIG. 1

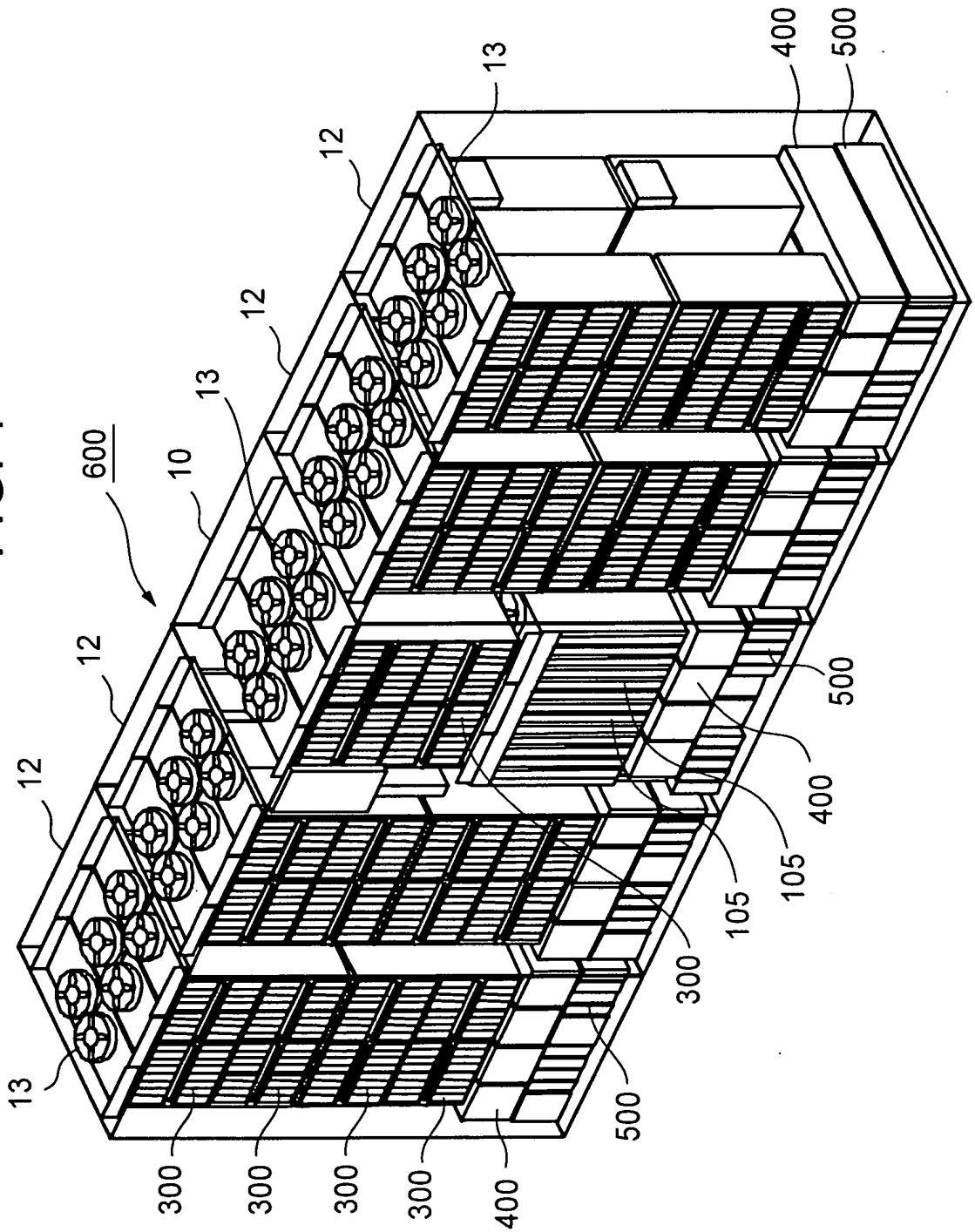


FIG. 2

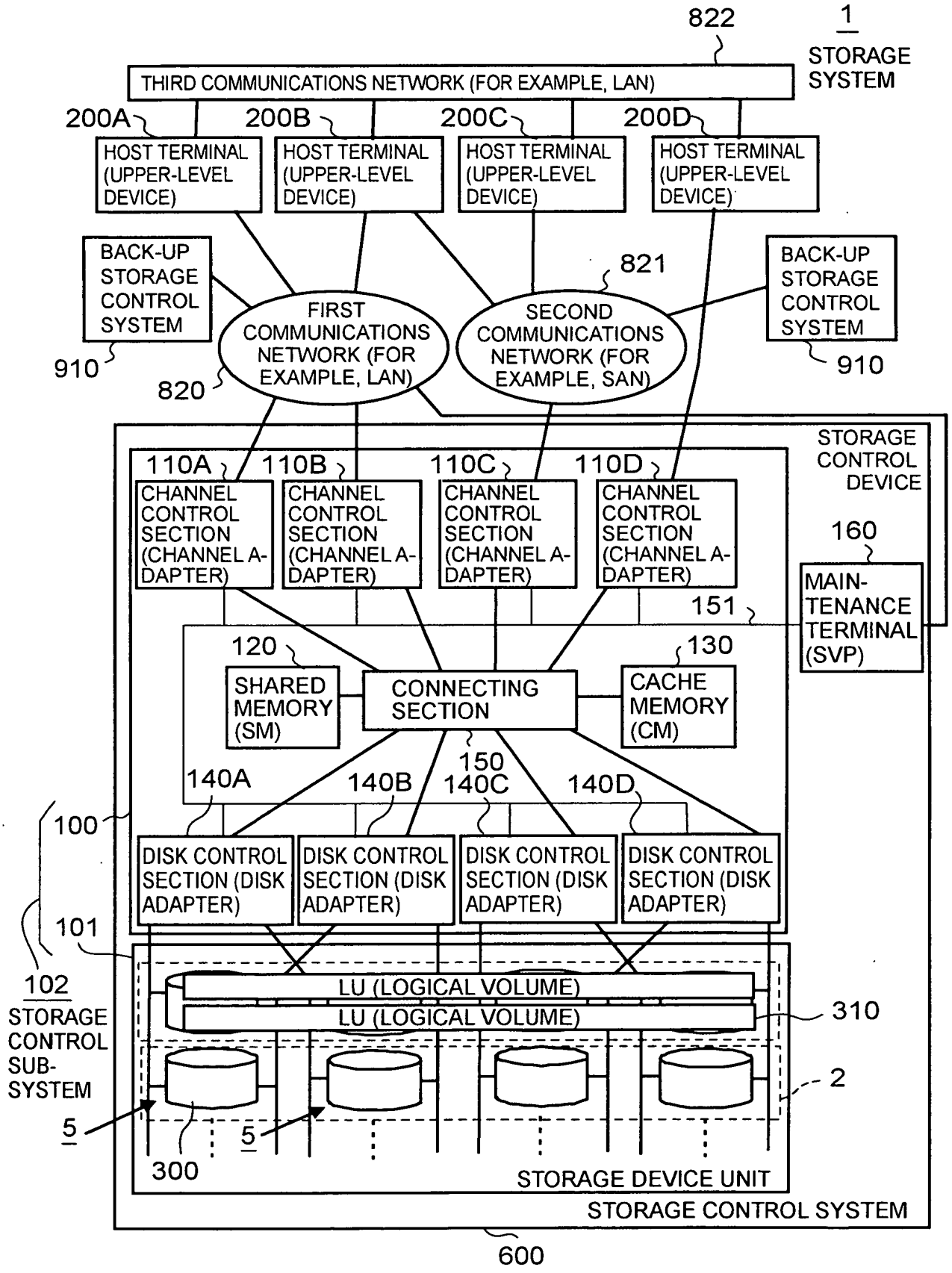

822
1
STORAGE SYSTEM
THIRD COMMUNICATIONS NETWORK (FOR EXAMPLE, LAN)
200A
200B
200C
200D
HOST TERMINAL (UPPER-LEVEL DEVICE)
HOST TERMINAL (UPPER-LEVEL DEVICE)
HOST TERMINAL (UPPER-LEVEL DEVICE)
HOST TERMINAL (UPPER-LEVEL DEVICE)
BACK-UP STORAGE CONTROL SYSTEM
910
821
FIRST COMMUNICATIONS NETWORK (FOR EXAMPLE, LAN)
820
SECOND COMMUNICATIONS NETWORK (FOR EXAMPLE, SAN)
BACK-UP STORAGE CONTROL SYSTEM
910
STORAGE CONTROL DEVICE
110A
110B
110C
110D
CHANNEL CONTROL SECTION (CHANNEL ADAPTER)
CHANNEL CONTROL SECTION (CHANNEL ADAPTER)
CHANNEL CONTROL SECTION (CHANNEL ADAPTER)
CHANNEL CONTROL SECTION (CHANNEL ADAPTER)
160
MAINTENANCE TERMINAL (SVP)
151
120
SHARED MEMORY (SM)
CONNECTING SECTION
130
CACHE MEMORY (CM)
150
140A
140B
140C
140D
100
DISK CONTROL SECTION (DISK ADAPTER)
DISK CONTROL SECTION (DISK ADAPTER)
DISK CONTROL SECTION (DISK ADAPTER)
DISK CONTROL SECTION (DISK ADAPTER)
101
102
STORAGE CONTROL SUB-SYSTEM
LU (LOGICAL VOLUME)
LU (LOGICAL VOLUME)
310
2
5
5
300
STORAGE DEVICE UNIT
STORAGE CONTROL SYSTEM
600

FIG. 3

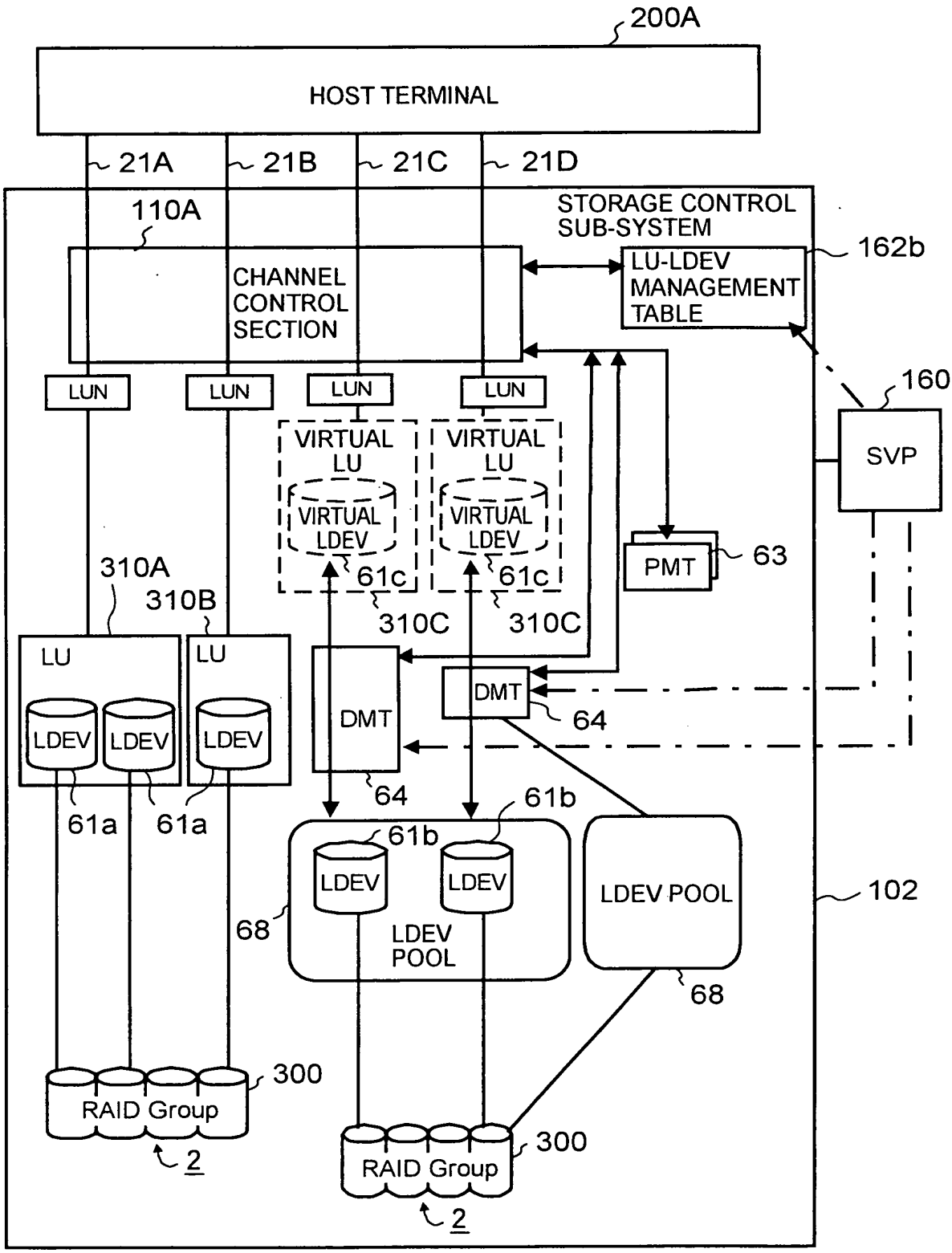

200A
HOST TERMINAL
21A
21B
21C
21D
110A
STORAGE CONTROL SUB-SYSTEM
CHANNEL CONTROL SECTION
LU-LDEV MANAGEMENT TABLE
162b
160
SVP
LUN
LUN
LUN
LUN
VIRTUAL LU
VIRTUAL LDEV
VIRTUAL LU
VIRTUAL LDEV
61c
61c
310C
310C
PMT
63
310A
310B
LU
LU
LDEV
LDEV
LDEV
DMT
DMT
64
64
61a
61a
61b
61b
LDEV
LDEV
LDEV POOL
68
LDEV POOL
68
102
RAID Group
300
2
RAID Group
300
2

FIG. 4

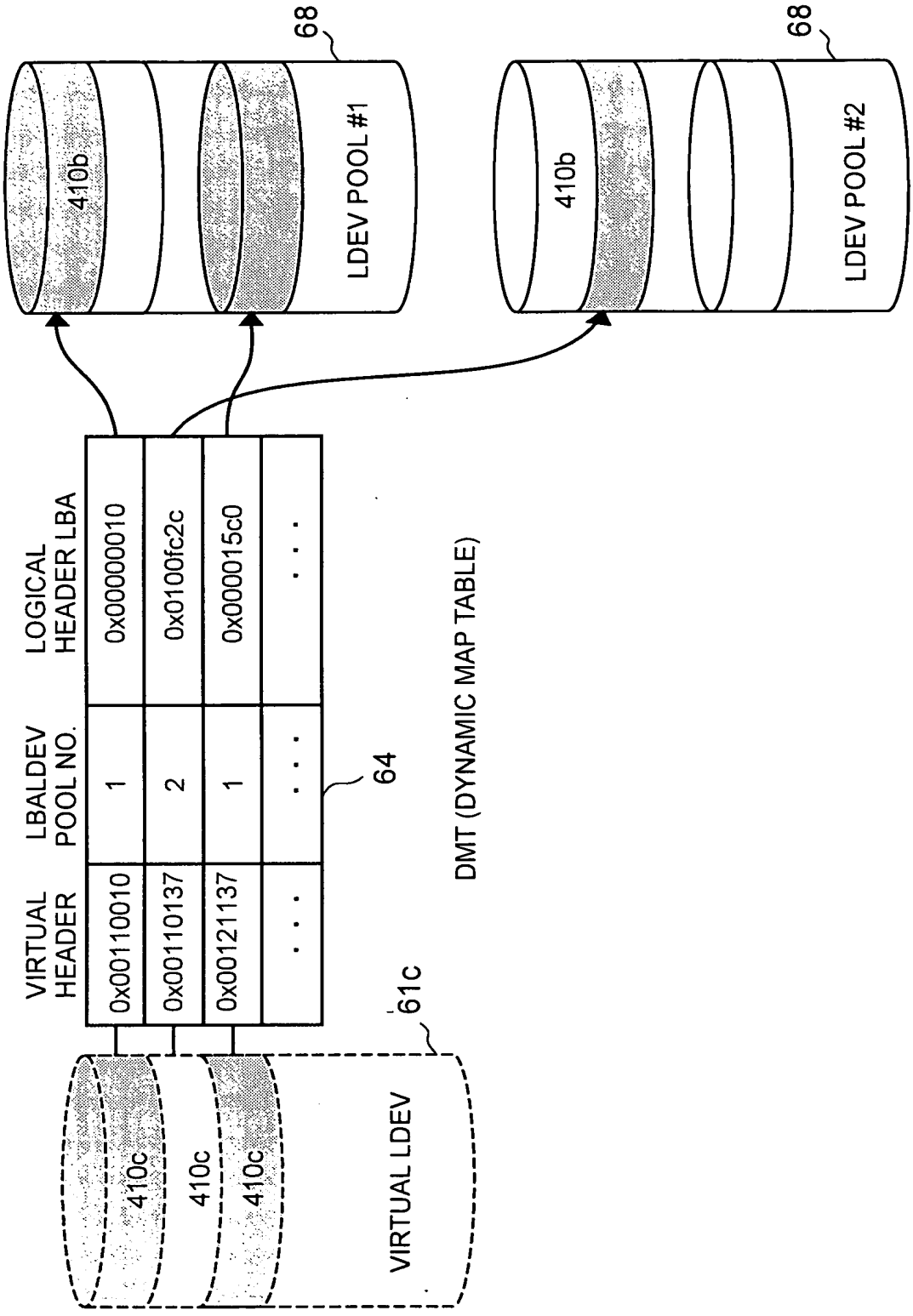

68
68
410b
LDEV POOL #1
410b
LDEV POOL #2
VIRTUAL HEADER
LBALDEV POOL NO.
LOGICAL HEADER LBA
0x00110010
1
0x00000010
0x00110137
2
0x0100fc2c
0x00121137
1
0x000015c0
64
DMT (DYNAMIC MAP TABLE)
61c
410c
410c
410c
VIRTUAL LDEV

FIG. 5

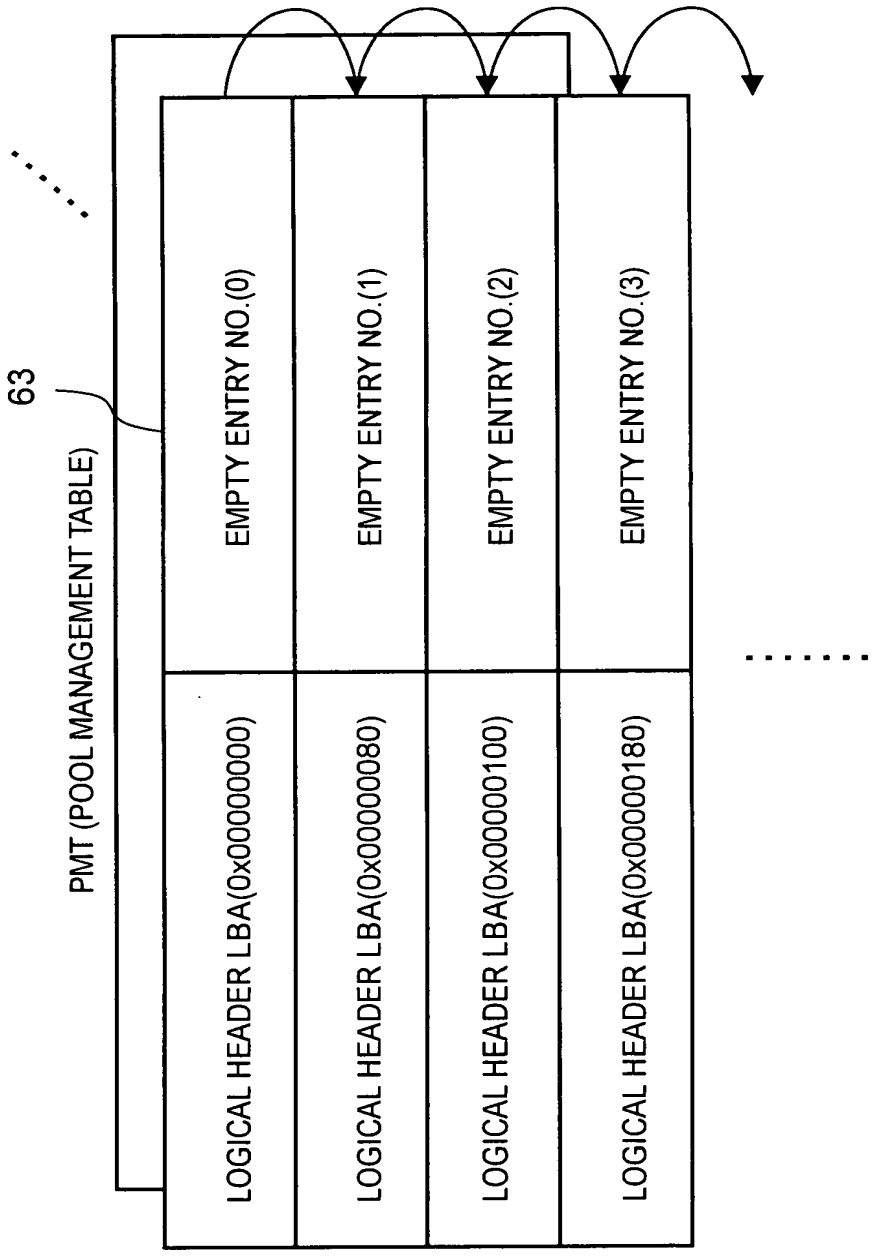

63
PMT (POOL MANAGEMENT TABLE)
EMPTY ENTRY NO.(0)
EMPTY ENTRY NO.(1)
EMPTY ENTRY NO.(2)
EMPTY ENTRY NO.(3)
LOGICAL HEADER LBA(0x00000000)
LOGICAL HEADER LBA(0x00000080)
LOGICAL HEADER LBA(0x00000100)
LOGICAL HEADER LBA(0x00000180)

FIG. 6

LU-LDEV MANAGEMENT TABLE

162b

PORT NO.	TARGET ID	LUN	LDEV #	STORAGE CAPACITY	RAID LEVEL	ADDRESS MANAGEMENT INFORMATION	LDEV ATTRIBUTE	DMT-ID	LDEV POOL NO.	STATUS	REPORT HOST ID
#1	–	–	LDEV #1	30GB	5	---------	POOL LDEV	–	#1	Ready	----
			LDEV #2	100GB	5	---------	POOL LDEV	–	#1	Ready	----
	#1	#002	LDEV #1	200GB	5	---------	VIRTUAL LDEV	0	#1、#2	Ready	----
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	#2	#001	LDEV #1	50GB	1	---------	NORMAL LDEV	–	–	Not Ready	----
#2	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮											

FIG. 7

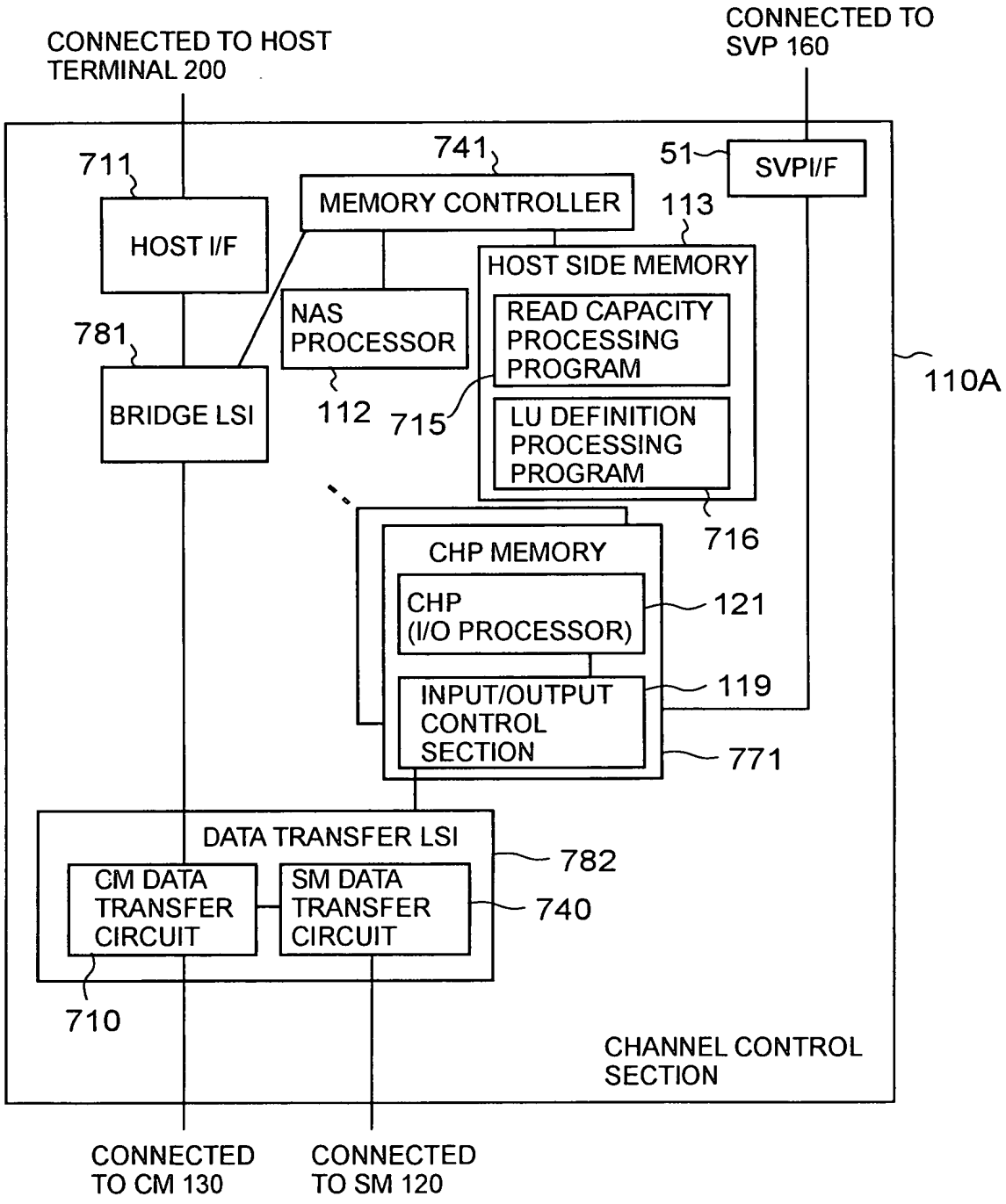

CONNECTED TO HOST TERMINAL 200
CONNECTED TO SVP 160
711
741
51
SVPI/F
MEMORY CONTROLLER
113
HOST I/F
HOST SIDE MEMORY
NAS PROCESSOR
READ CAPACITY PROCESSING PROGRAM
781
110A
BRIDGE LSI
112
715
LU DEFINITION PROCESSING PROGRAM
716
CHP MEMORY
CHP (I/O PROCESSOR)
121
INPUT/OUTPUT CONTROL SECTION
119
771
DATA TRANSFER LSI
782
CM DATA TRANSFER CIRCUIT
SM DATA TRANSFER CIRCUIT
740
710
CHANNEL CONTROL SECTION
CONNECTED TO CM 130
CONNECTED TO SM 120

FIG. 8

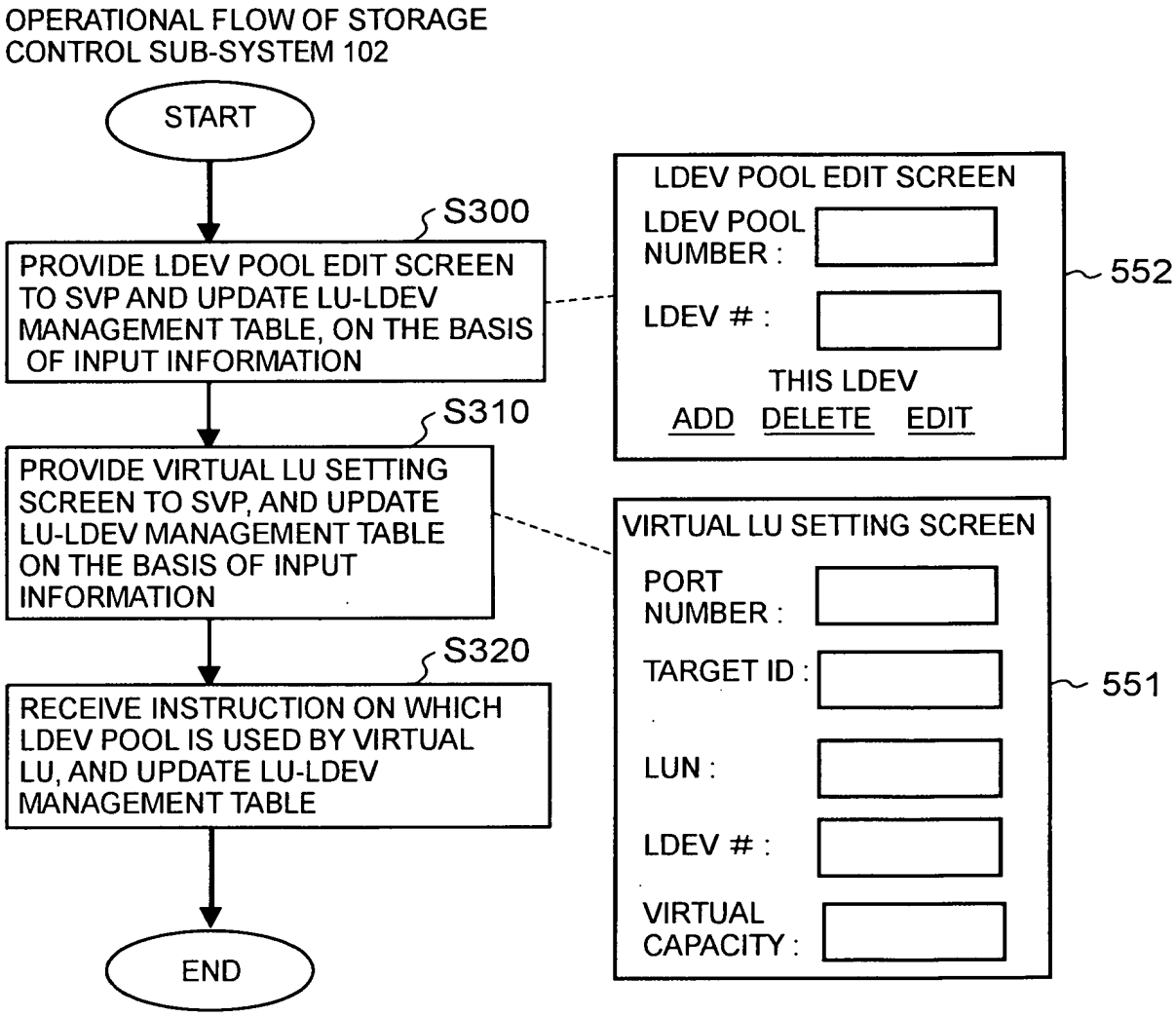

OPERATIONAL FLOW OF STORAGE CONTROL SUB-SYSTEM 102
START
S300
PROVIDE LDEV POOL EDIT SCREEN TO SVP AND UPDATE LU-LDEV MANAGEMENT TABLE, ON THE BASIS OF INPUT INFORMATION
S310
PROVIDE VIRTUAL LU SETTING SCREEN TO SVP, AND UPDATE LU-LDEV MANAGEMENT TABLE ON THE BASIS OF INPUT INFORMATION
S320
RECEIVE INSTRUCTION ON WHICH LDEV POOL IS USED BY VIRTUAL LU, AND UPDATE LU-LDEV MANAGEMENT TABLE
END
LDEV POOL EDIT SCREEN
LDEV POOL NUMBER :
LDEV # :
THIS LDEV
ADD DELETE EDIT
552
VIRTUAL LU SETTING SCREEN
PORT NUMBER :
TARGET ID :
LUN :
LDEV # :
VIRTUAL CAPACITY :
551

FIG. 9

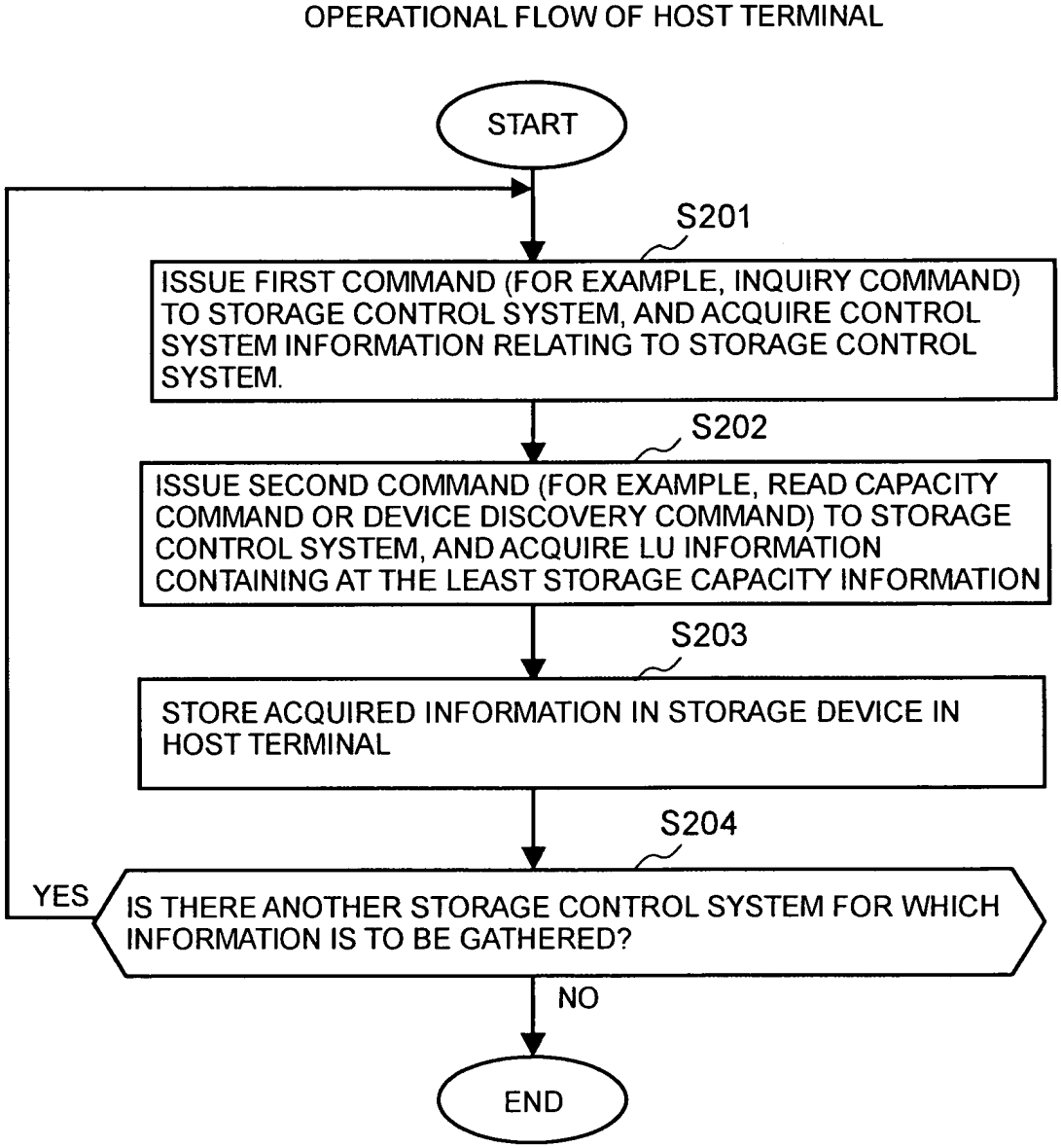

OPERATIONAL FLOW OF HOST TERMINAL
START
S201
ISSUE FIRST COMMAND (FOR EXAMPLE, INQUIRY COMMAND) TO STORAGE CONTROL SYSTEM, AND ACQUIRE CONTROL SYSTEM INFORMATION RELATING TO STORAGE CONTROL SYSTEM.
S202
ISSUE SECOND COMMAND (FOR EXAMPLE, READ CAPACITY COMMAND OR DEVICE DISCOVERY COMMAND) TO STORAGE CONTROL SYSTEM, AND ACQUIRE LU INFORMATION CONTAINING AT THE LEAST STORAGE CAPACITY INFORMATION
S203
STORE ACQUIRED INFORMATION IN STORAGE DEVICE IN HOST TERMINAL
S204
YES
IS THERE ANOTHER STORAGE CONTROL SYSTEM FOR WHICH INFORMATION IS TO BE GATHERED?
NO
END

FIG. 10

STORAGE CONTROL SYSTEM MANAGEMENT TABLE

791

PORT NUMBER	TARGET ID	LUN	VENDOR	MODEL	STORAGE CAPACITY	----
0	0	0	CO. H	OPEN-3	1000GB	----
1	1	1	CO. H	OPEN-9	2000GB	----
⋮	⋮	⋮	⋮	⋮		⋮

FIG. 11

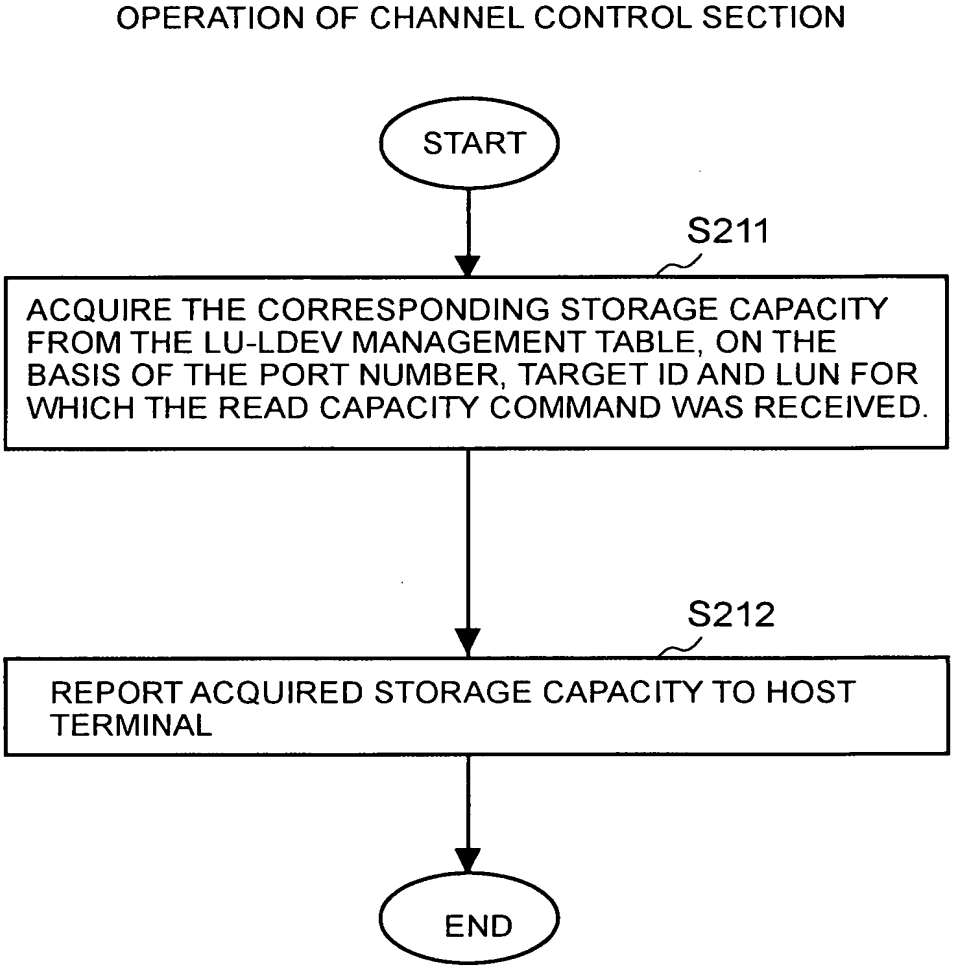

OPERATION OF CHANNEL CONTROL SECTION
START
S211
ACQUIRE THE CORRESPONDING STORAGE CAPACITY FROM THE LU-LDEV MANAGEMENT TABLE, ON THE BASIS OF THE PORT NUMBER, TARGET ID AND LUN FOR WHICH THE READ CAPACITY COMMAND WAS RECEIVED.
S212
REPORT ACQUIRED STORAGE CAPACITY TO HOST TERMINAL
END

FIG. 12

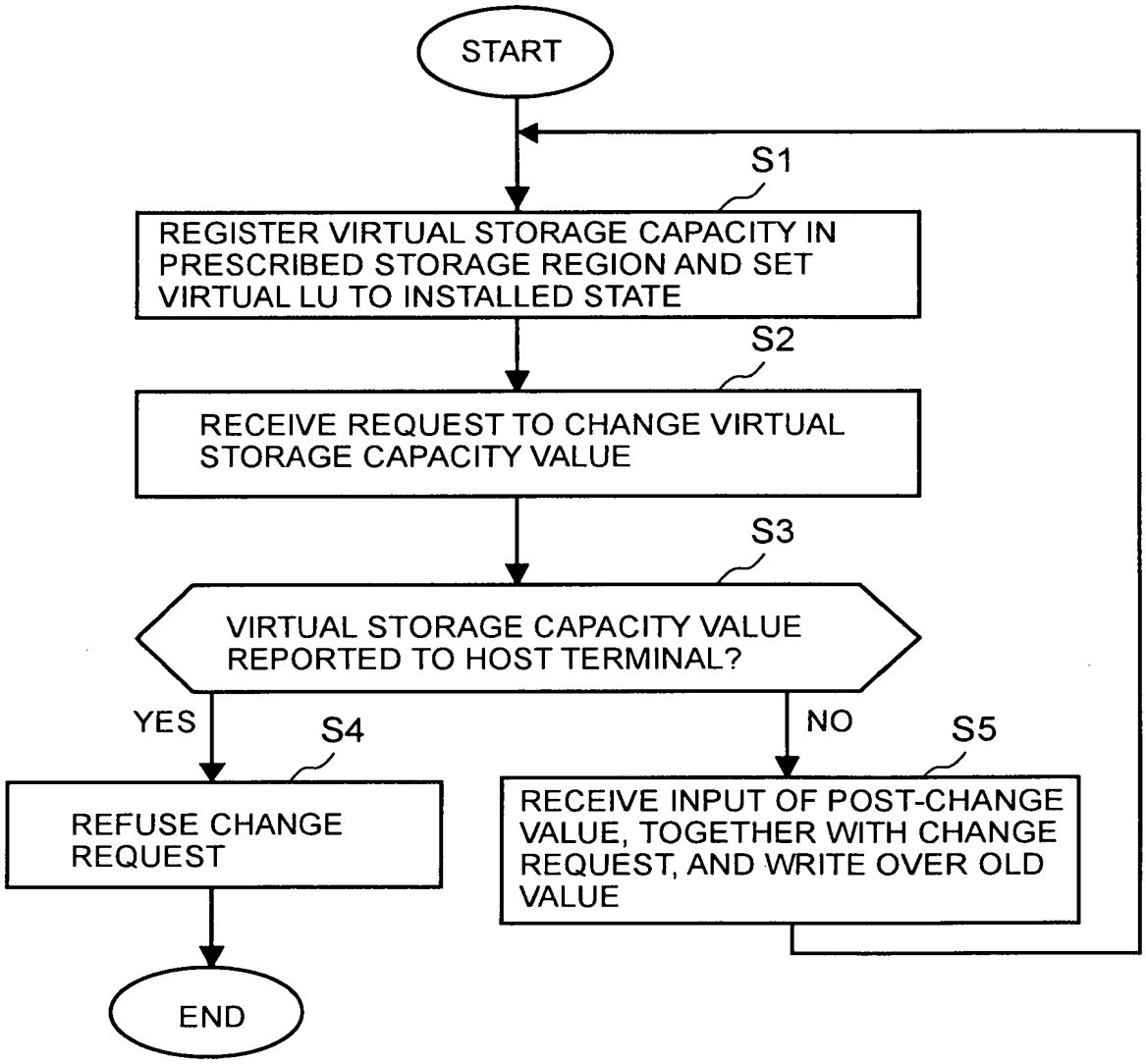

START
S1
REGISTER VIRTUAL STORAGE CAPACITY IN PRESCRIBED STORAGE REGION AND SET VIRTUAL LU TO INSTALLED STATE
S2
RECEIVE REQUEST TO CHANGE VIRTUAL STORAGE CAPACITY VALUE
S3
VIRTUAL STORAGE CAPACITY VALUE REPORTED TO HOST TERMINAL?
YES
S4
REFUSE CHANGE REQUEST
END
NO
S5
RECEIVE INPUT OF POST-CHANGE VALUE, TOGETHER WITH CHANGE REQUEST, AND WRITE OVER OLD VALUE

FIG. 13

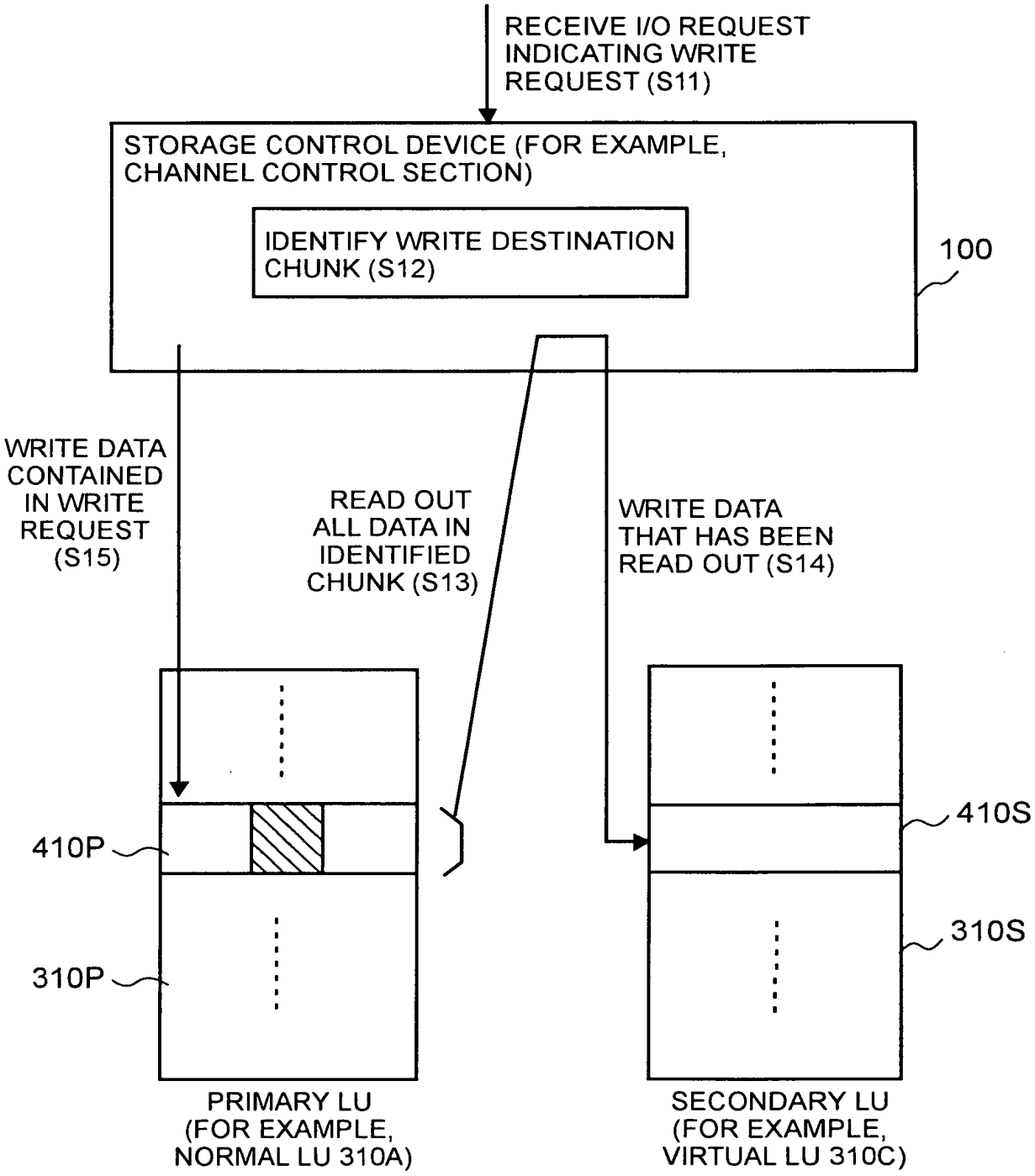

RECEIVE I/O REQUEST INDICATING WRITE REQUEST (S11)
STORAGE CONTROL DEVICE (FOR EXAMPLE, CHANNEL CONTROL SECTION)
IDENTIFY WRITE DESTINATION CHUNK (S12)
100
WRITE DATA CONTAINED IN WRITE REQUEST (S15)
READ OUT ALL DATA IN IDENTIFIED CHUNK (S13)
WRITE DATA THAT HAS BEEN READ OUT (S14)
410P
310P
410S
310S
PRIMARY LU (FOR EXAMPLE, NORMAL LU 310A)
SECONDARY LU (FOR EXAMPLE, VIRTUAL LU 310C)

FIG. 14

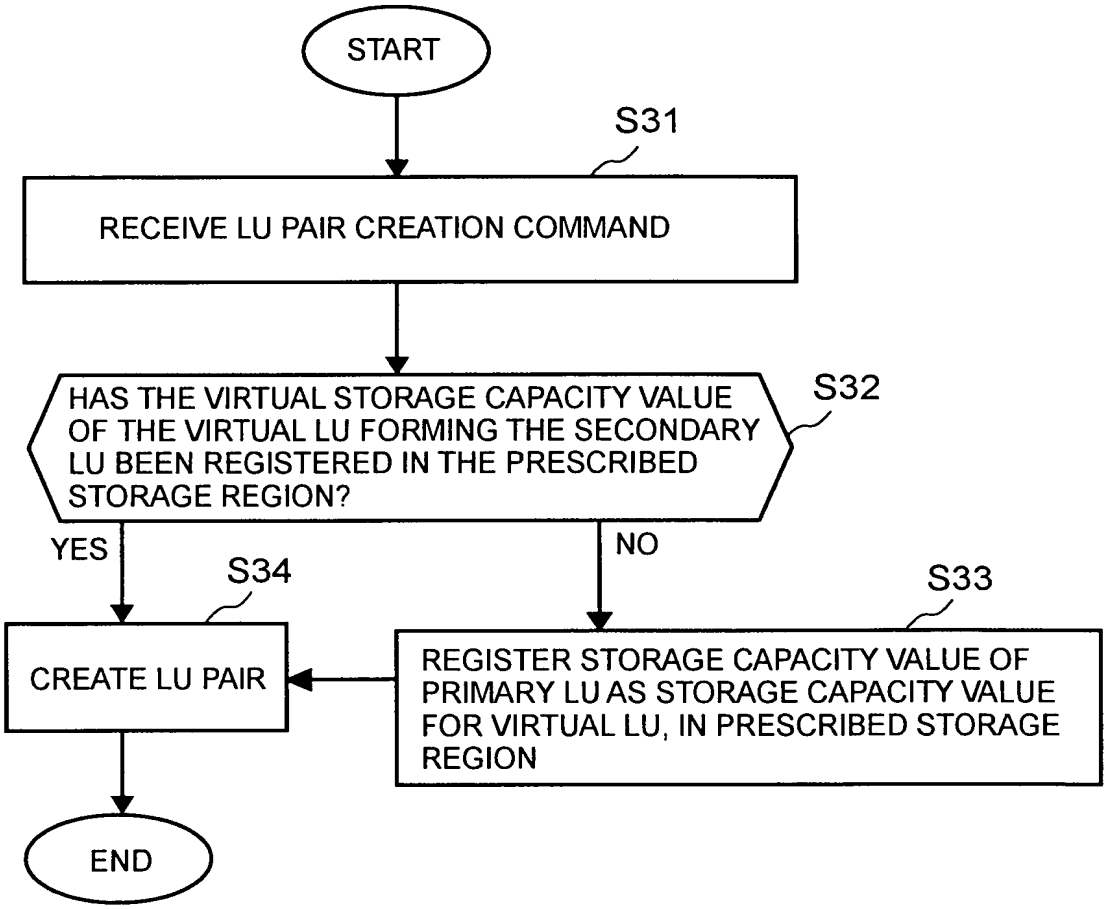

START
S31
RECEIVE LU PAIR CREATION COMMAND
HAS THE VIRTUAL STORAGE CAPACITY VALUE OF THE VIRTUAL LU FORMING THE SECONDARY LU BEEN REGISTERED IN THE PRESCRIBED STORAGE REGION?
S32
YES
NO
S34
S33
CREATE LU PAIR
REGISTER STORAGE CAPACITY VALUE OF PRIMARY LU AS STORAGE CAPACITY VALUE FOR VIRTUAL LU, IN PRESCRIBED STORAGE REGION
END

FIG. 15

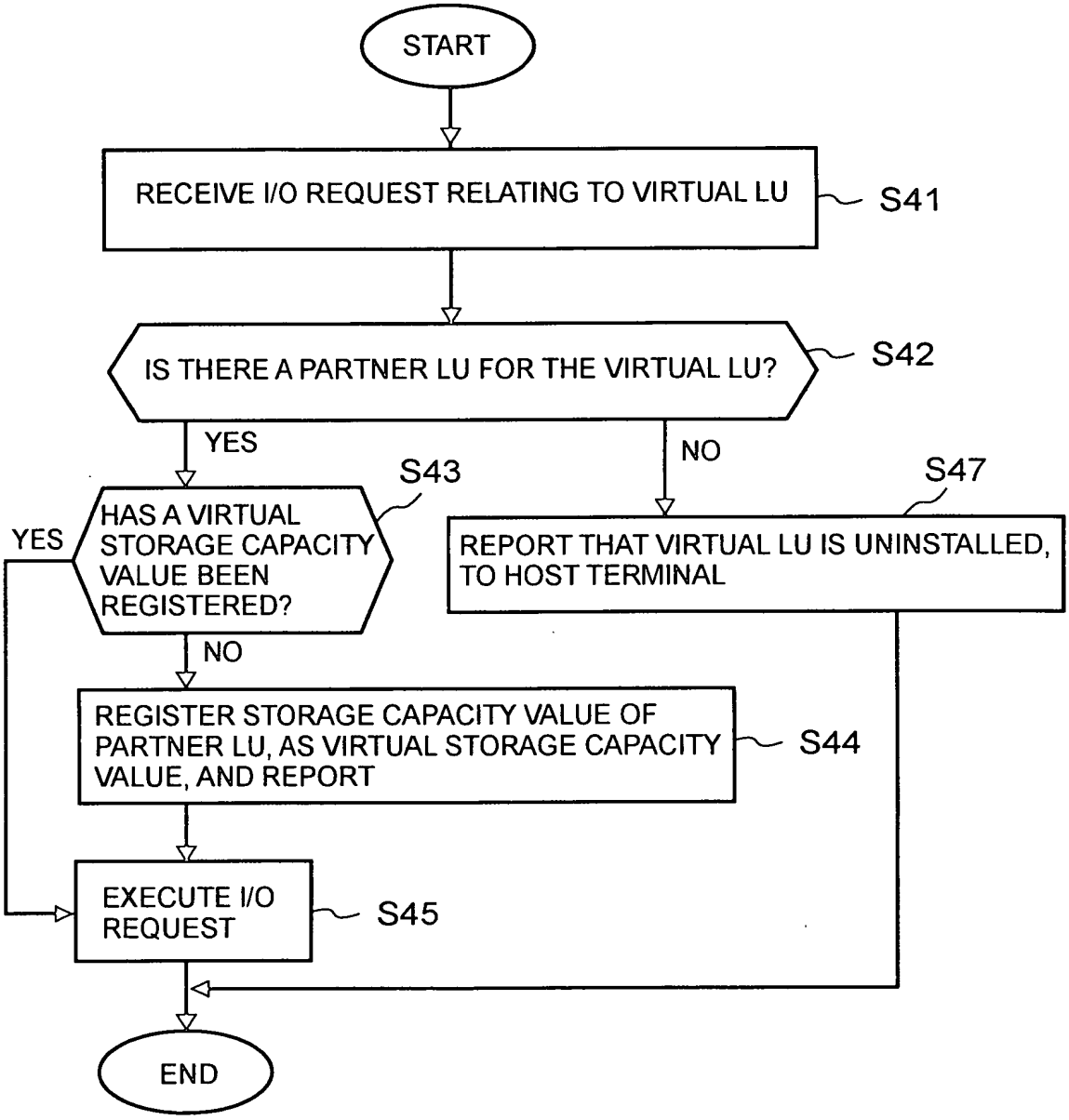
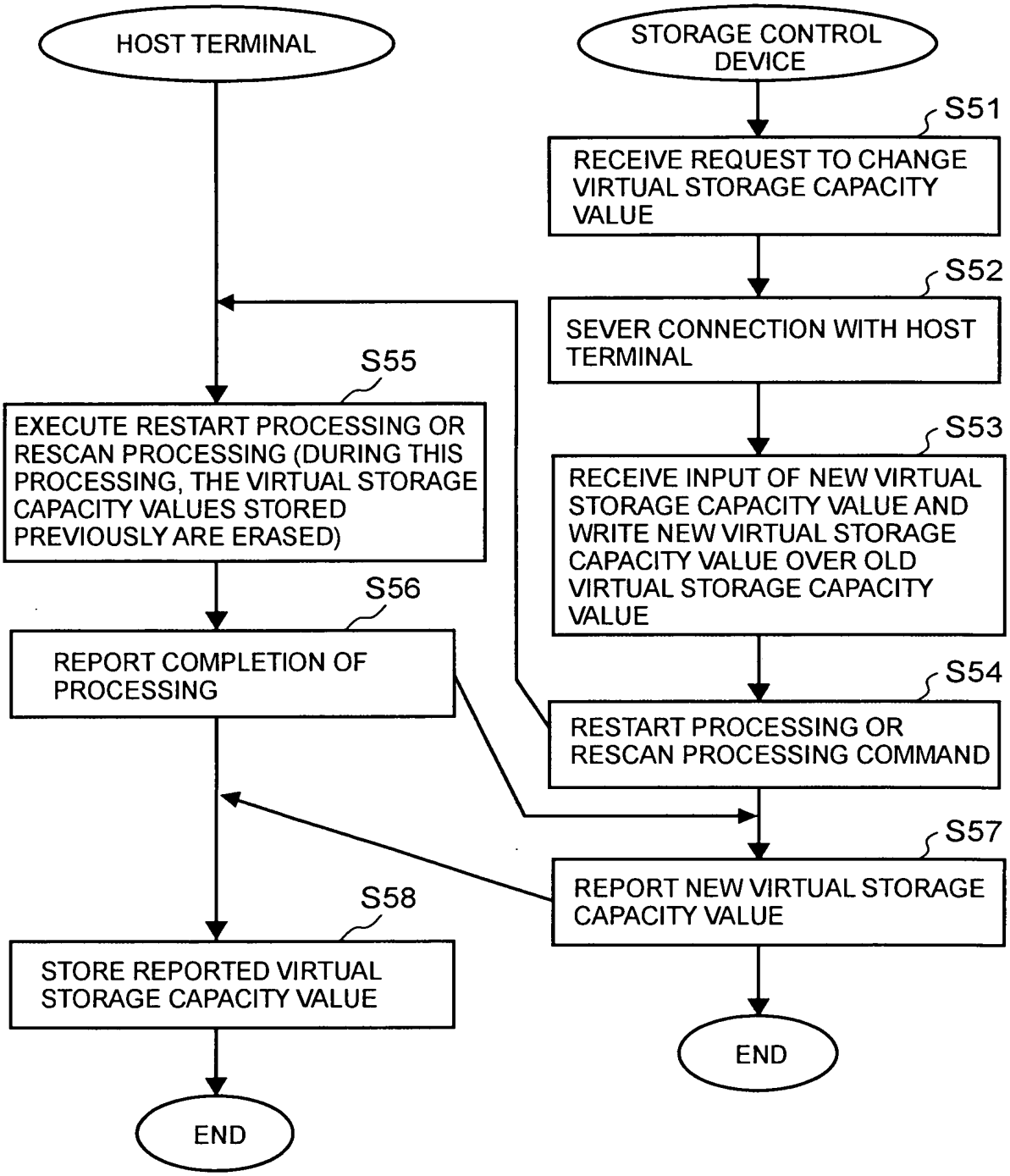

START
RECEIVE I/O REQUEST RELATING TO VIRTUAL LU
S41
IS THERE A PARTNER LU FOR THE VIRTUAL LU?
S42
YES
NO
S43
HAS A VIRTUAL STORAGE CAPACITY VALUE BEEN REGISTERED?
YES
S47
REPORT THAT VIRTUAL LU IS UNINSTALLED, TO HOST TERMINAL
NO
REGISTER STORAGE CAPACITY VALUE OF PARTNER LU, AS VIRTUAL STORAGE CAPACITY VALUE, AND REPORT
S44
EXECUTE I/O REQUEST
S45
END

FIG. 16


HOST TERMINAL
STORAGE CONTROL DEVICE
S51
RECEIVE REQUEST TO CHANGE VIRTUAL STORAGE CAPACITY VALUE
S52
SEVER CONNECTION WITH HOST TERMINAL
S53
RECEIVE INPUT OF NEW VIRTUAL STORAGE CAPACITY VALUE AND WRITE NEW VIRTUAL STORAGE CAPACITY VALUE OVER OLD VIRTUAL STORAGE CAPACITY VALUE
S54
RESTART PROCESSING OR RESCAN PROCESSING COMMAND
S55
EXECUTE RESTART PROCESSING OR RESCAN PROCESSING (DURING THIS PROCESSING, THE VIRTUAL STORAGE CAPACITY VALUES STORED PREVIOUSLY ARE ERASED)
S56
REPORT COMPLETION OF PROCESSING
S57
REPORT NEW VIRTUAL STORAGE CAPACITY VALUE
S58
STORE REPORTED VIRTUAL STORAGE CAPACITY VALUE
END
END